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# SYSTEMIC EXPLORATION : A METALOGUE ON WATER GOVERNANCE IN JAKARTA AND ENVIRONS

**Lisman Manurung,.[1], Janet, J. McIntyre-Mills[2], Rudolf Wirawan[3], Ida Widianingsih,[4] Riswanda, Riswanda.[5], Indra Gunawan, I[6]. Arief Nasrudin[7], Arthur Simon Josiah Runturambi[8]**

**Corresponding author : janet.mcintyre@adelaide.edu.au**

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**Abstract:** In this metalogue we discuss the shared aim of a community of practice led by the Janet which is to move from siloed water management to systemic governance to protect biodiversity and the sources of water. The paper reflects on ways forward to address water insecurity associated with climate change and governance challenges in West Java within the broader regional context. Our twofold focus is:
*Firstly,* on the systemic governance of water from upstream villages at risk of de-forestation , ground water loss and risk to food security, to the plains of Jakarta where the urban poor live on the banks of flood plains, to the coast where mangroves are at risk of deforestation increasing flood risks, storm surges and loss of habitat for multiple species.
*Secondly,* we focus on ways to link the systemic governance of water with a circular green economy to foster engagement spanning upstream villages , midstream flood plains to coastal villages and marine environments. Water security is more than the management of water provision , it is about protecting the sources of water. This is a critical systemic case study led by the Janet discusses the implications for social and environmental justice with a focus on Jakarta where water is provided by a public private partnership. The issues we explore are access, availability and accountability within the context of systemic social, economic and environmental biodiversity challenges. We also raise the potential of undertaking multi stakeholder engagement and the creation of a multi- stakeholder co-operative that could be scaled up with communities in line with the one village many enterprises approach adapted from the past President Jakowi's approach.
The water governance issue is systemic and demands policy networking instead of conflicting policies. The exploratory case studies make the case that government, NGOs, small to medium enterprises need to work together to support the circular green economy through incentives.

**Keywords**
systemic, ethics, governance , interdependence, circular economy and multi-species habitats .

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[1] University of Indonesia
[2] Adjunct Research Fellow, University of Adelaide, Professor Extraordinarius, University of Indonesia and Adjunct Professor University of Indonesia
[3] PhD student, University of Adelaide
[4] Professor in International Development Administration ,Faculty of Social and Political Sciences Universitas Padjadjaran, Indonesia
[5] Associate Professor Public Administration Deprtment, Universitas Sultan Ageng, Tirtayasa, Indonesia
[6] Uni of Adelaide
[7] CEO of Pamjaya
[8] Uni of Indonesia

## 1. Introduction and statement of the governance problem

**Janet**: The paper builds on a program of research to find ways to protect the global commons and to support , learn from and advocate for participatory engagement by exploring what works why and how to support[i] Elinor Ostrom's principles as detailed elsewhere through participatory action research on the cyclical green economy approach (McIntyre-Mills, Makaulule et al, 2023, Widianingsih, McIntyre-Mills et al, 2023, Wirawan, McIntyre-Mills et al, 2023 and forthcoming[ii]) which addresses mitigation and adaptation by learning from case studies that demonstrate low or zero emissions through applying a relational approach to living with nature ) in which the location of our research responds to the challenge of water and food insecurity in areas where development and urbanization is rapidly destroying habitat.

We build on our shared social and environmental justice concerns about climate change and the need for systemic governance to address mitigation and adaptation from the highlands areas where re-forestation and protection of the water table along with re-generative agriculture and businesses need to be encouraged through systemic participatory governance. Zoom engagement via community of practice with policy and governance stakeholders, NGO leaders to discuss water insecurity and agro-ecology leaders.

We discuss small pilots which inform this work on addressing circular , organic economies to protect and re-generate the environment( McIntyre-Mills et al , 2023, Wirawan and McIntyre-Mills et al , 2023 and Widianingsih). This paper contributes by reflecting on upstream, midstream and downstream case studies and interviews with stakeholders.

The area of concern requires a critical systemic approach to address the related concerns with a sociologist, demographer, town planner , indigenous leaders with local knowledge of the environment in catchment areas, public administration, oceanographer , water researchers with agro ecology background. To address the causes of the problem and to address mitigation and adaptation to climate change in line with the United Nations 2030 Agenda and the Sendai Risk platform which highlights the risk associated with climate change , water insecurity and in particular the challenges for big cities , such as Jakarta.

The problem requires a critical systemic interventionist approach with decision makers who respond to the local knowledge of residents living in the water catchment areas, the city and in the coastal areas where run off from the polluted areas places which places the mangroves and marine life at risk from inorganic petrochemicals and plastics, whist deforestation upstream impacts ground cover, soil fertility ,erosion and rising food costs.

The loss of mangroves will jeopardize marine life and add to the risks of flooding in Bantam as storm surges increase.

Provincial governance is needed to protect biodiversity and habitat along the full length of the thirteen rivers that flow into Jakarta. The Citarum river itself is known to be one of the most polluted.

Our concern is to address mitigation and adaptation to climate change in line with the United Nations 2030 Agenda and the Sendai Risk platform which highlights the risk associated with climate change, water insecurity and in particular the challenges for big cities , such as Jakarta. The problem requires a systemic interventionist approach with decision makers who respond to the local knowledge of residents living in the water catchment areas, the city and in the coastal areas where run off from the polluted Citarum, for example places the mangroves and marine life at risk from inorganic petrochemicals and plastics, whist deforestation upstream will impact ground cover, soil fertility ,erosion and rising food costs; whilst the loss of mangroves will jeopardise marine life and add to the risks of flooding in Bantam as storm surges increase.

In line with the latest IPCC synthesis report ( 2023) this paper works with local policy knowledge holders using a metalogue approach with academics and practitioners who are concerned about climate change. According to the World Bank : Vision 2045 for Indonesia , page xv)

> "Water demand is continuing to rise fast under demographic and economic forces and is expected to increase by 31 percent between 2015 and 2045. By 2045, 31 river basins, out of 128, are expected to face a water supply-demand deficit."

## 2. Transformative praxis :explaining the metalogue approach

**Janet:** Third order cybernetics[iii] allows for reflection on conversations to inspire a community of practice. Drawing on earlier work, this research is informed by Maturana and Varela's biological frame all living systems and their environments (which include other living systems as well as all communication) are coupled so that they grow and change together, each influencing the possibilities of the other. Murray et al. (2007) cite Von Foerster (1992) who in turn cite Maturana and Varela who explain that the system does not adapt to the environment but both change over time as they become structurally coupled. This is an iterative process (Maturana, 2002). Von Foerster ( 1992) explains that second order cybernetics is the study of dynamic relationships and the observation of these relationships can then lead to joining up the dots (see McIntyre-Mills, 2008, McIntyre-Mills et al 2014).

This series of conversations inspired further reflection (McIntyre-Mills, 2023) on dynamics , displacement as a result of the changing environment and the implications for systemic governance food, energy and water security. The conversations build on long standing relationships fostered since 2006 and support third order transformational change. In our metalogue we reflect on the Participatory Action Research, Mixed methods and Critical Ethnography approaches used in the case studies.

Our multidisciplinary team[iv] members use a case study approach relying on local focus group discussions with stakeholders and Zoom engagement to address the area of concern, namely :

What provision is the Jakarta Water Management Company making to ensure compliance with the UN Sustainable Development Goals? Furthermore we ask : What regenerative measures are being taken to protect forests in the water catchment areas and to protect the rivers, springs, streams and dams?

We work across upstream, midstream and coastal communities to assess social, economic and environmental indicators of wellbeing and make policy recommendations to support systemic participatory governance that rewards local residents for protecting the catchment areas, forests and local habitat through circular green economies and agro-ecology . Our approach builds on Manurung's thesis on water provision and the associated challenges of providing water to the urban poor of Jakarta and recent work on the low lying flood prone areas where the urban poor are located.

Our research, supported by the University of Adelaide, the University of Indonesia, Universitas Padjadjaran and Universitas Sultan Agang is enabled through collaboration in a community of practice spanning the public, private sector providers, indigenous knowledge holders and NGOs . The research in Indonesia complies with ethical research standards as each member of the community of practice is given a copy of the protocols to which the team complies. The data collected from the stories will be used to produce an influencer map based on social, economic and environmental well-being indicators which policymakers can use to monitor the complex social, economic and environmental wellbeing of the Citarum River and its environs. Exploring ways to improve the lives of the urban poor could involve mapping and modelling water quality linked with addressing job creation through re-purposing rubbish as way to clean up the rivers nd narrow canals built originally by the Dutch colonists.

In our conversations to date the Lisman has discussed *firstly*, the way in which the poor are criminalised for settling along the river banks and *secondly* in this thesis you emphasised that the poor are also victims of the high cost of water and thirdly you made the case that water is stolen in many ways, from damaging pipes to making arrangements that favour businesses and water vendors. The bottom line is that the poor pay more as they have to buy bottled water or risk becoming ill by using contaminated water sources.

Our conversations bring into being policy reconceptualization through a metalogue approach (Bateson, 1972). Together we engage in a series of policy conversations and strives to make sense of so-called contextual warm data ( Bateson, 2021) to support deeper local understanding. The role of the Janet is to help shape policy[v] together with the named authors including early career academics, a CEO of a large water company in Jakarta, a journalist who work with the community in Depok, Jakarta.

Simbolon ( 2019 : 285) underlines that Indonesia provides constitutional support for the right to water security for all and the implications of corruption on public health and stresses:

> "The Indonesian Constitution article 33 states that 'The land, the waters and the natural resources within shall be under the powers of the State and shall be used to the greatest benefit of the people'. It goes on to say that in Indonesia, government has the responsibility to provide public utilities to the people. In terms of providing water, Indonesia has implemented the decentralised system in water management, meaning that the responsibility of water provision is one of local governments.'"

A more co-ordinated approach is vital to achieve better governance. If forests are protected upstream and mangroves are protected along the coastal regions this could support one of the systemic dimensions to protecting the ecosystem. The soil needs to be protected by organic farming and seed protection whilst communities need to be encouraged to 'do the right thing' through enabling community members and those living in informal settlements along the river to earn, learn and grow a future. Many in the Depok and other regions could be encouraged to help with garbage collection and recycling. At seminars at University of Indonesia the issue of garbage collection and recycling was raised. Pam Jaya could join Uni of Indonesia a to make transformative research feasible.

Our aim is to encourage green cyclical economy along the river systems to help protect the up, mid and downstream villages through upscaling a point system based on mapping social, economic and environmental indicators of wellbeing (See McIntyre-Mills et al 2008, 2014, 2017, 2018, 2021, McIntyre-Mills and Wirawan 2022, Wirawan and McIntyre-Mills et al , 2023) Wirawan and McIntyre-Mills et al 2022, 2023) . This seems a practical way forward, if it is combined with more emphasis on some wider engineering interventions: perhaps floating platforms and better preventative and regenerative measures by protecting multiple species and our shared habitat, through re-vegetating forests and coastal areas.

But even this option does not respond to the dynamics of large scale geo-volcanic disruptions. Only early warning systems of tsunamis and forward planning could help with this. Other big picture responses are understanding overshoot and balancing human and other species needs to share one habitat (Rees, 2011, 2021m, 2022) whilst being mindful that giving more agency, opportunities and rights ( Nussbaum 2011) to women and not criminalising LBG2 people could help to hasten the demographic transition – which is yet another vital step towards addressing complex needs. Overshoot ( Rees, 2021,2022) needs to be understood within the context of exploitation of the environment and the powerless by societies and economies of every stripe . Nation states simply do not address the reality of a dynamic molten planet which is warming faster than previously anticipated.

Cutting down forests in Borneo to make way for the people of Jakarta will destroy the forests that capture carbon and thus makes planetary warming accelerate. So working with nature ( to the extent that we can) and knowing our ( fragile) place within it seems very important. It would be tempting to say that wicked complex problems (with many social, historical, cultural, political, economic and environmental variables which are perceived differently by different stakeholders (see Flood and Carson 1992 Churchman 1967, Rittel and Webber 1984) are largely intractable but it remains necessary to try to come up with policy responses or at least to gain better insights for systemic governance.

Volcanoes have made Java fertile and the farmer's benefit from the soils created by volcanic eruptions in places like Alamendah. Visiting a crater near Alamendah together with a team from Universitas Padjadjaran whilst working with local farmers[vi] underlined the size of the eruptions and the dynamic nature of the hills around Java lined by low lying paddy fields and terraced tea, coffee and vegetables ( McIntyre-Mills and Romm , 2018).Perhaps more emphasis on empowering people through green circular enterprises could help and we could build on Jokowi's vision of one village one or many enterprises?

**Rudolf Wirawan:** Yes, the concept of building a multi-stakeholder service cooperative with the latest technology to create passive income for communities in the Citarum Watershed region is aimed at promoting sustainable economic growth and improving the livelihoods of local communities.

The Citarum Watershed region is located in West Java, Indonesia, and is home to around 9 million people. The region faces numerous environmental and socio-economic challenges, including high levels of pollution, deforestation, and poverty. The development of a multi-stakeholder service cooperative with the

latest technology presents an opportunity to address these challenges and promote sustainable development in the region.

A multi-stakeholder cooperative is a business model that involves the participation of different stakeholders, including producers, consumers, and other stakeholders such as investors, government, and civil society organizations. The cooperative model encourages the sharing of resources, knowledge, and benefits, and provides a platform for communities to work together towards a common goal….community of practice to the principles of organic agroecology and explain the importance of protecting ground cover and the water table through re-forestation and organic agriculture

**Janet:** If we consider the situation of the population living along the banks of the Citarum river upstream in the highlands of Tarumajaya, on the plains in Depok, Jakarta and in the coastal areas of Bantam Province, it is clear that the loss of habitat for multiple species results in human poverty expressed as a rise in debt and landlessness as big commercial plantations displace people and from forests , farming lands and river banks as the military try to clean up the river and at times overstock the river with fish so that the water quality fluctuates.

However, the success of this approach depends on the collaboration and participation of all stakeholders, including the government, private sector, local communities, and civil society organizations. It is crucial to work together towards the common goal of restoring the Citarum River and ensuring the long-term sustainability of water resources in West Java.

We call on all stakeholders to take action by investing in the proposed smart cleaning approach, promoting sustainable practices, and supporting community-based initiatives. With collective efforts, we can restore the Citarum River and create a more sustainable future for West Java.

**Rudolf:** We need to demonstrate how this has been done in Tarumajaya, Depok and Bantam province by pooling the data we have collected so it can be mapped.

## 3. Our metalogue with policy makers and thought leaders

**Lisman** : “Janet, your overview encapsulates the essence of the systemic approach we need, emphasizing the integration of various disciplines and the crucial role of provincial governance in safeguarding our ecosystems. However, I want to draw our attention to the human element within this system, particularly the communities along the Jakarta riverbanks. Their precarious existence highlights a critical gap in our urban planning and social safety nets."

**Simon**: "Indeed, Janet. Their situation underscores the need for inclusive policies that consider the socio-economic realities of all city residents. How do you propose we integrate these communities into our systemic approach?"

**Lisman**: "Firstly, we must recognize these communities not just as victims of circumstance, but as potential partners in our environmental stewardship efforts. Their daily experiences and struggles provide invaluable insights into the river's health and the challenges of living in close proximity to polluted waterways."

**Arief**: "That's an important perspective. Their firsthand knowledge could indeed be pivotal. But how do we engage with them effectively?"

**Lisman**: "Engagement must start with trust-building and acknowledgment of their rights and contributions. We can initiate community-led monitoring programs, where residents are trained to collect data on water quality and pollution sources. This not only empowers them but also provides us with critical data points for our broader environmental management strategies."

**Indra**: Our urban environments face significant water management challenges, from supply and distribution to conservation and sustainability. My approach, from an engineering and project management perspective, emphasizes the need for efficient, data-driven systems. But I'm keen to integrate your insights on community engagement and urban planning to develop holistic solutions."

**Lisman**: "Absolutely, Indra. The community's role cannot be understated. Engagement and education are key to fostering a culture of sustainability. In Depok, for instance, we've seen how community-led initiatives can significantly impact waste management and water conservation. The challenge lies in scaling these efforts and integrating them with the technical solutions you mentioned."

**Rudolf**: "I concur with both of you. From an urban planning standpoint, the spatial layout and infrastructure design of our cities play a pivotal role. We must consider 'blue-green infrastructure' to enhance urban resilience. This includes creating permeable surfaces, green roofs, and rain gardens to manage stormwater and mitigate flood risks, all of which complement your data-driven and community-focused approaches."

**Indra**: "Rudolf, that's an excellent point. Incorporating 'blue-green infrastructure' aligns with the idea of making cities more adaptive and resilient to climate change. The integration of such infrastructure with advanced monitoring and management systems could revolutionize how we manage urban water cycles."

**Author**: "Indeed, and let's not overlook the potential of citizen science in this context. By empowering residents to collect and share data on water usage and quality, we can enhance our understanding of urban water dynamics and foster a more participatory approach to water governance."

**Rudolf**: "Integrating citizen science with 'blue-green infrastructure' offers a promising pathway. It not only engages the community but also enhances the functionality and aesthetic appeal of urban spaces, contributing to public well-being."

**Indra**: "It's clear that our interdisciplinary approach can yield innovative solutions. The next step is to pilot integrated projects that combine engineering excellence with community engagement and urban ecological design. Such pilots could serve as models for sustainable urban water management."

**Lisman**: "Collaboration with local governments and stakeholders will be crucial in implementing these pilots. Securing their buy-in and support can pave the way for broader adoption."

**Rudolf**: "And let's ensure these initiatives are adaptable and scalable. The goal is to create resilient urban water systems that can be replicated in other cities facing similar challenges."

**Indra**: "Agreed. Let's outline a roadmap for a pilot project, incorporating our collective expertise. This could be the beginning of a transformative approach to urban water management. Incorporating local knowledge into scientific research could bridge gaps between academia and community experiences. What about their economic inclusion?"

**Author**: "Economic inclusion is paramount. We should explore creating green job opportunities that align with their skills and the needs of the ecosystem. For example, initiatives like community-based waste management and recycling programs can provide employment while addressing environmental concerns. Moreover, promoting agroecology and organic farming in accessible areas can lead to sustainable livelihoods that also contribute to soil and water conservation."

**Indra**: "These are tangible solutions, Janet. But implementation would require significant collaboration across sectors."

**Author**: "Absolutely, Indra. Collaboration is key. Engaging with NGOs, private sectors, and government agencies to support these initiatives can lead to sustainable models of community participation in urban environmental management. It's about creating a synergy where environmental protection and socio-economic development go hand in hand, reflecting a true systemic approach. Your insights bring a crucial dimension to our discussion, Janet. Integrating the socio-economic aspects with environmental goals can lead to a more holistic and sustainable urban future for Jakarta..

Janet: This is also the case in the coastal areas where Riswanda (2018a,b), a member of the community of practice and also a PhD graduate works on critical systemic determinants of poverty and social injustice. In terms of gender perspective, the ground rules of policy making start with mapping out gender equality issues.

## 3.1. From localised water management to governance to protect biodiversity and the sources of water

**Janet:** Water insecurity is associated with climate change and governance challenges. We aim to demonstrate that by encouraging local villagers to support regenerative and sustainable living. We will map social , economic and environmental indicators and encourage upstream villagers to protect the commons for their own benefit and downstream users. We will focus on working with indigenous knowledge systems and local knowledge. We use a combination of qualitative stories that are analysed for social, economic and environmental indicators to find patterns which are then identified and mapped across the categories 'business as usual', 'small changes' and 're-generative living'.

**Business as usual scenario : we deny what is going on around us:** We continue to believe in economic arguments that others believe ignore the social and environmental dimension. We continue to think that our way of life is sustainable and are not prepared to manage the perceived risks of climate change by changing our way of life. We attribute floods to one-off unrelated events or natural cycles, and deny that climate change can trigger rising temperatures in some areas and plummeting temperatures in others as melting ice effects the ocean currents. We do not perceive that the sea is used as a dumping ground to the extent that it no longer helps to regulate our climate.

**Small changes scenario : too little too late:** People are too slow to change and the result is that people and the environment suffer.

**Regenerative approach :** The team engages with The CEO /Managers of the Jakarta water company to address water dignity for the poorest of the poor in Jakarta using a constructivist approach to engage with forestry and environmental affairs portfolios and to discuss ways to protect water security. We work together with others to support wellbeing through earning, learning and growing a future together. The idea is to use the scenarios as starting points to explore ways to enable people to live healthy, happy ethical lives that are not at the expense of others or the next generation of life. Please think about your own life in terms of how to make a difference in terms of **social, economic and environmental indicators** of wellbeing:

| |
|---|
| *We have* the following social /economic/environmental resources to help set up a social enterprise. |
| *We need* the following to help us set up a social enterprise |
| *We will add* to our lives – more community supports from a range of services and /or more community engagement to lobby for resources, more connection to one another and ways to protect the river and our shared environment /setting up co-op or recycling , upcycling |
| *We will discard* from my life – a sense of hopelessness …… |
| Self-reflection on *the turning points* for the better or worse – hope that we can turn the plastic and rubbish into a recycling business. |
| Consideration of the barriers that currently exist and consideration of what could be done to transform our community and our relationship to the river and surrounding communities. |

**Rudolf :** Mapping across the three areas using the logic of pathways to wellbeing and story pathways ( see companion paper submitted to ISSS 66$^{th}$Conference,2024) would be vital. The potential to restore the quality of the rivers will help to enable the re-vegetation of the mangroves to prevent flooding . Thus the entire river system needs to be protected to re-generate water security. Upstream forests could continue to protect springs and ground water , organic farming and better prevention and management of refuse could help enhance the quality of water.

The issues we need to explore are access, availability and accountability within the context of systemic social, economic and environmental biodiversity challenges.

To address water insecurity we need to address not only climate change and global warming that poses an existential risk, but the size of our carbon footprint and the destruction of multispecies habitats. Mitigation and adaptation requires learning from case studies that demonstrate low or zero emissions through applying a relational approach to living with nature.

**Riswanda:** Localized water companies already sell water downstream from Tarumajaya which results in locals suffering from the lack of water.Currently water policy differs across different authorities given Indonesian local autonomy politics[vii]

**Janet**: It is worth unpacking what a community- public – private partnership would look like.

**Ida Widianingsih and Riswanda** : By regional autonomy politics, as part of 1998 Indonesia political reform, local politics influence the way local authorities execute water management. Some regions set up their own political boundaries of which shapes river management as well. Citarum River and Cidadane River for example show different management influenced by each region very own local politics trait (West Java Provincial government and Banten Provincial Government). Public-private-community partnership could be a way to work across different political boundary. National priority budget would be delivered to regions with some degrees of innovations linking in corporate social responsibility funding.

**Riswanda**: International funding such as from JAICA, ADB and AUSAID plays a significant role in some Indonesian development projects. Community-driven project becomes one of pre-requirement for such international partnership usually.

Tangerang is in Banten Province where I am now located in Cidurian-Cidadane authority. It is buffer zone in hinterland of Jakarta - the water governance issue is systemic and demands for policy networking instead of conflict.

**Janet**: Yes, the mangroves , for example need to be protected to mitigate flooding and to protect habitat of marine life. The prevention of pollution upstream will also protect the livelihood of the fisherfolk. Protection of habitat goes hand in hand with preventing the commodification of water.

**Riswanda**: Water privatisation is today's issue in the country due to the lack of clean water especially in dry season and in areas where water becomes commodity

**Janet:** Instead a systemic transformative approach could provide gainful , mainstream employment which could be evaluated to assess what works, why and how , in order to scale up the venture along the riverside informal settlements. Lisman confirmed that the CEO of Pamjaya Mr. Arief and his staff members, who attended the meeting and that the universities could support education and empowerment and that marketing and training could be supported to address :

Mr. Arief Nasrudin's concerns as chair of Pamjaya, Jakarta's largest provider of water are about water availability and water loss in Jakarta :

**Arief Nasrudin**: "Thank you, Prof. Janet, for highlighting the systemic nature of our water governance challenges. It's true that the PPP model we adopted faced significant hurdles, not least of which were issues of transparency and effectiveness. While the initial intentions were to leverage private sector efficiencies for public good, the reality has been far more complex."

**Janet**: "Indeed, Mr. Arief. The complexities of water governance in a megacity like Jakarta demand innovative approaches. What do you see as the way forward?"

**Arief Nasrudin**: "Moving forward, we must learn from our past experiences. The termination of the PPP contract offers us a unique opportunity to reset our approach to water governance. It's imperative that we embrace a more inclusive model that integrates community voices, leverages technological advancements, and strengthens public sector capacity. Communities, especially those directly affected like those along the riverbanks, hold invaluable knowledge and insights into the water system's challenges. We plan to initiate participatory water management projects that empower these communities, turning them from passive recipients to active stewards of the water resources…We're exploring smart water management technologies that can help us monitor water quality, distribution, and usage in real-time. This will not only reduce water loss but also ensure equitable distribution across Jakarta. Moreover, we're keen

on adopting sustainable practices such as rainwater harvesting and wastewater recycling to augment our water supply."

**Janet**: "It sounds like a comprehensive shift is on the horizon. How will you ensure these plans are realized?"

**Arief Nasrudin**: "Collaboration and accountability are key. We're committed to working closely with local and international experts, NGOs, and the private sector under a framework of transparency and shared goals. Regular audits, public reporting, and stakeholder meetings will be part of our accountability measures. Together, we can redefine Jakarta's water governance for a sustainable and equitable future."

**Lisman:** This requires the President Director's permission. If the proposal accelerates the termination of the contract, then the business profits that should have accrued to the other partner must be paid.

**Arief :** Of course, and we've finished it. The management transition process and others have been carried out since February 2023. Currently we are making various improvements so that the aim of meeting the needs of residents can be completed.

**Lisman**: "Mr. Arief, with the acceleration of the contract termination, I'm curious about the financial implications for our partners. Ensuring a fair settlement is crucial for maintaining trust and integrity in our future endeavors."

**Arief**: "Lisman, your concern is valid. We've meticulously addressed the financial aspects associated with the early contract termination. All due compensations have been settled to uphold our commitments and ensure an amicable resolution. It's part of our broader strategy to transition towards a more sustainable and community-focused water governance model."

**Lisman**: "… Could you share more about the transition process and how it's paving the way for these essential improvements?"

**Arief**: "Certainly. Since February 2023, we've embarked on a comprehensive transition, which includes not only management changes but also technological upgrades and policy reforms. Our primary goal is to enhance the efficiency and reliability of water provision, ensuring that every resident's needs are met with the utmost consideration for sustainability and equity."

**Janet**: "It sounds like a significant overhaul is underway. How do you envision these improvements impacting the residents, especially in underserved areas?"

**Arief**: "Our focus is squarely on the community. We're implementing decentralized water management systems to improve access in underserved regions and introducing water-saving technologies to reduce waste. Moreover, community engagement programs are being launched to involve residents in water conservation efforts, making water governance a shared responsibility."

**Janet**: "Engaging the community in such a direct manner is commendable. It seems like a promising step towards more inclusive and effective water governance."

**Arief**: "Absolutely, Janet. We believe that the path to sustainable water management is through collaboration, innovation, and a deep commitment to the well-being of all Jakarta's residents. It's a challenging journey, but one we are fully committed to."

**Janet:** I understand from our discussions via WhatsApp and Zoom that the political context of research is not without difficulties and that you have a team collecting data on the living conditions of the poorest of the poor. The meetings with Mr Arief and members of your team during June to September underlined that the problems are short, medium and long term and can be summarised as follows: include the following potential steps:

- Protect sources of water by protecting forests and soil though preventing deforestation and organic farming https://cities4forests.com/partner-articles/a-5-step-plan-to-protect-and-restore-indonesias-forests/
- Prevent pollution – chemicals, plastic, fecal content
- Pollution of the river pollutes the ocean
- Treat water - through sewerage plants
- Prevent wasting water though incentives and transparency through water metres in households or streets

- Provide education on ways to manage the ecological footprint through setting up locally based enterprises to support a circular green economy rooted in Jokowi's 'One Village, One or Many Enterprises'[viii]
- Provide culturally appropriate public health education on ways to manage the population through a demographic transition Together we agreed that a systemic approach would entail a regional socio-economic and environmental governance approach that addresses both *protecting* the *sources* of water for West Java as well *as governance of the supply of water resources. This goes beyond the mere management of water supply.*

**Rudolf :** It requires local governments in collaboration with local providers to support and subsidize rainfall catchments , well and spring management and the management of refuse , sanitation and chemical wastes in the informal settlement areas of Jakarta.

**Janet:** It will need provincial collaboration[ix]. Lisman and Simon, please tell us more about the political challenges and some of the ways forward that you have been exploring?

**Lisman:** Mr. Simon's observations should be explored in more depth. The impacts of mountain water mining are still rarely studied, especially in the highland areas around Jakarta. A decrease in the water table is inevitable. However, the consequences, namely the increasing difficulty for residents to obtain drinking water, should be studied carefully. Local legislators would do well to research this. Currently, a democratic political process in Indonesia within the framework of policy making has strengthened. The local government has elected officials, namely members of the Regional People's Representative Council. Apart from that, the SDGs goal for 2030 agenda regarding the government's obligation to achieve sufficient drinking water is only 6 years away. Rainwater harvesting, enhance the management of wells and springs, and improve waste, sanitation, and chemical waste management in informal settlements."

**Janet**: "Such an approach indeed necessitates broad cooperation. Simon, could you shed light on the political intricacies and potential strategies you've encountered in your work?"

**Simon**: "A significant concern is the reliance on estimated over 3,000 tankers daily transporting water from Sukabumi to Jakarta. The extraction of spring water using high-capacity pumps is causing a drastic drop in the water table, affecting local communities' access to water. The socio-economic divide is widening as those with fewer resources struggle to secure water for basic needs."

**Lisman**: "Simon's point underscores a critical issue—the environmental and social fallout from unsustainable water extraction in our highlands. This practice not only depletes our water reserves but also places a disproportionate burden on the less privileged, exacerbating water inequity. It's imperative we conduct comprehensive studies to understand the full scope of these practices and their repercussions. The urgency of addressing these issues cannot be overstated, especially with the looming SDGs deadline. How do we navigate these challenges within the current political landscape?"

**Ida**: "The evolving democratic process in Indonesia offers a unique opportunity for engagement and advocacy. Elected local representatives, particularly within the Regional People's Representative Council, play a crucial role. We must leverage this political framework to advocate for policies that ensure sustainable water management and equitable access, aligning with the SDGs."

**Wirawan**: "Indeed, the path forward involves not only technological and infrastructural changes but also a paradigm shift in how we govern and value water. This requires an integrated approach, involving all stakeholders from policymakers to local communities, to redefine water management in a way that is sustainable, equitable, and resilient."

**Wirawan**: "The sustainability of Jakarta's water hinges on collaborative efforts. Local governments and providers must jointly invest in and promote

**Janet:** In the forthcoming volume " Affirmative Intervention to support Multispecies Relationships( McIntyre-Mills, 2024), I cite the 2023 IPCC synthesis report for policy makers stresses that global warming poses an existential risk :

> "This report recognizes the interdependence of climate, ecosystems and biodiversity, and human societies; the value of diverse forms of knowledge; and the close linkages between climate change adaptation, mitigation, ecosystem health, human well-being and sustainable development, and reflects the increasing diversity of actors involved in climate action."

The loss of farm land and destruction of the water sources is caused by development at the expense of habitat on which human beings and other species are dependent.

Manurung explains that water delivery through PPP is an issue and his thesis made a case that PP partnerships could have an uneasy relationship between public sector organisations set up for the public good and private companies responsible for profits from the management and delivery of water services in Jakarta[x].

## 3.2. Regional water governance is still a pipe dream

**Janet:** West Java *as a whole* has a PPP approach according to Ida Widianingsih and Riswanda ( personal communication, 2023) who confirmed that selling water from one village to another could be very problematic as water companies are already doing this to maximise profits but at the expense of the common good. Wirawan suggests that small enterprises could aim to do this, but it could be self-defeating if the motive is profit. In Ciangur , rice is regarded as sacred and it is not commodified (Widianingsih et al,2023) . according to the Indonesian constitution water ought to be regarded as a right . Simbolan ( 2019) in his PhD[xi] thesis and related works ( Simbolan and McIntyre-Mills, 2019a) detailed the way in which small providers compete for areas as water providers and that the affordability of a commodified. The wicked problem (Simbolon and McIntyre-Mills, 2019b.) of dissolving PPP is that it is possible that some companies may become even more profit driven.

**Ida :** The website in this screen shot summarises the collaborative policy across water companies managed by a PPP in West Java Source [xii].

**Riswanda** : It is clear from our research so far that the water governance issue is systemic and demands policy networking instead of conflicting policies which could make some form of co-operation feasible. The proposal detailed below could only occur if regional co-operation occurs

**Janet:** From our discussions of the various case studies so far the governance issues can be summarised as follows

#### 3.2.1.1. The Water Governance issues

| Highlands<br>Taramjaya[xiii] | Flood Plains<br>Depok , Jakarta[xiv] | Coastal areas<br>Bantenxv |
|---|---|---|
| Largely landless population without home ownership, population working for public or private land owners. The forest and river could be ecotourism centres<br>The welfare issues of the aged need more attention . Vocational training in organic farming is needed and education is needed to | Highly congested informal housing along polluted canals which could be a source of revenue if the area developed co-ops to collect , re and upcycle materials | Coastal villages prone to flooding with tourism potential if the focus is on the protection of marine life and re-generating the mangrove forests. . |

| | | |
|---|---|---|
| enable villagers to do on line marketing | | |
| Tea, livestock and some organic farming<br>Overstocking of the river with fish by the military and pressure on landless to move away from the river areas.<br>High level of indebtedness of women sometimes as a result of borrowing directly from loan sharks and sometimes as a result of identity theft | Informal sector food stores and Pedi carts , small urban gardens. This group also face pressure to move away from the river banks | Tourism, fishing and seaweed farming for alternative sources of protein |
| Few farmers are engaged in organic farming and the river is at risk of being overstocked with fish by the military and polluted by inorganic fertilisers. | Highly polluted river canals with plastic containers, sewerage and chemicals , air and noise pollution from traffic and industries. | Polluted coastal waters with micro plastics and chemicals that jeopardise marine life |
| Potential to set up a green circular economy which promotes water security and which is supported by the public and private sectors<br>The risk is that business as usual prevails which puts the entire Citarum river and surrounding habitats at risk.<br>The opportunity is to promote agro-ecology and to trade credits for scoring well in terms of social, economic and environmental wellbeing[xvi] | Potential to work with Pamjaya, NGOs and local small entrepreneurs to set up socio-environmental enterprises to help with garbage management from the household to *prevent* river pollution and to address river clean ups in the meantime | The health of the river impacts marine life and the loss of mangroves makes storm surges more likely.<br>The opportunity is to re-generate coastal dunes and mangroves |

Source: McIntyre-Mills et al , 2024 forthcoming

**Lisman :** Depok is an area of varying life chances , including high and middle income households. The University of Indonesia campus and low income areas along the river, thus providing an ideal case study on the accessibility of safe water. Depok , Jakarta has a local water delivery approach.

…. Pam Jaya will be the user of our research. ….as the company faces many changes . This change in PPP also impacted the Jakarta Water Service (1997-2023) …. This is in line with the policy suggestions made in my PhD dissertation advice to reform the PPP and now it has just happened.

The gate is now open to [encourage Pam Jaya] to provide fresh water to the urban poor, and what we need to explore is how to make connectedness among SDGs, to protecting the ocean from plastic rubbish and strategically develop the business of 5 R among the urban poor that are living along the river banks from upstream to downstream.

Jakarta is a growing urban centre that is facing two problems: climate change and urban poverty. City authority of Jakarta has yet to prepare comprehensive public policies to address the two challenges of the

city that has over 9 million population. As a coastal city, Jakarta has a coastline up to 25 km long. The average elevation of land surface is 7 meters above sea level. Around 40 percent of land surface are below the sea level. There are thirteen rivers flowing rainwater from high land of West Java through the city running into Jakarta Bay. Therefore the threat of climate change is not only due to rising sea levels but also flooding and drought. It is estimated that around 1 million of the urban poor experiencing the vulnerability since most of them are illegally occupying the low land surrounding riversides.

Extreme weather events occur in both in urban and rural areas. Since poor farmers and farm workers have no savings, some of them have trying to get the job in cities such as Jakarta. Since the urban poor have only subsistence income, they choose to live at the riversides in many parts of Jakarta and use many sources of water including wells to tap underground water . Another issue is dumping the waste into the river. I have already undertaken research to learn more about the problem . My concerns centre on:

- What do the urban poor know and do regarding the water resources?
- How will climate change impact their survival? I have attempted to explore the linkages of how climate change …effects the urban poor….This study tries to develop how the current water governance needs to effectively address the problem.

**Janet :** This is a worthwhile area of concern that builds on your PhD thesis, titled *" Jakarta Water Service: The case of an uneasy public–private partnership*[xvii] in which you explore the difficulties of public-private partnerships when Jim Schiller and I worked with you as supervisors. As an Indonesianist, Schiller's insights were pooed with my insights as a sociologist with a focus on critical systemic ethnographies. Your thesis explored the social history, cultural and economic context of water governance. It is good news that you are now working with the CEO of Pam Jaya, a PhD student of University of Indonesia, in order to address his governance concerns. Please tell us more about your research with the communities ?

- How did you go about drawing on local knowledge about survival in the city?
- What is the potential to co-ordinate their re-cycling , re-purposing of waste materials as a means to support the circular green economy and simultaneously to help reduce pollution and the dangers of flooding in the low lying areas in Depok, Jakarta where you have been working.

**Lisman :** In Jakarta the approximately 2 million people living along the river banks are regarded as law breakers. The problem of 15 % of urban poor remains. An approach to provide them opportunities for a better life can be linked with a green economy approach .We need to assess the SDGs that can be addressed through implementing the circular green economy (CE) by mapping indicators of wellbeing.

**Janet:** Yes, our focus could be to encourage the implantation of many small projects along the river banks to minimize dumping plastic in the rivers and to monitor the reduction in waste and the improvement of job creation opportunities

**Lisman :** Yes and this will also help to protect biodiversity. I am increasingly fascinated by the PAR approach to building shared understanding between community members and researchers.

## 4. The issue of water justice: a focusing shot of regional case studies spanning highlands and lowlands areas

Together we need to monitor wellbeing indicators in villages spanning the highland, flood plains and a coastal region. In this paper we build on the joint research in Tarumajaya by adding Depok ,Jakarta and Bantam Province, each of these areas is discussed below:

### 4.1 Tarumajaya , West Java

Tarumajaya is a highlands forested rural area with a population of 3.6 million in 2022 [xviii]which is under threat of deforestation by the establishment of a new military base and further economic development which could impact water security .

Widianingsih[xix] ( 2022, pes comm) and her students researched the impact of selling water downstream on the water security of upstream users who cannot afford the costs of buying water[xx] .

**Ida :** Only about 30 % of households have access to clean water.

**Janet**: Thus water insecurity is related to unaffordable privatization practices..

The focus of this joint paper is on the lowlands Depok region. Where I am doing systemic research on water governance in Jakarta.

**Janet**: Yes, we are contextualizing the water security issue through considering the environmental context where the community of practice are working across regional case studies using participatory action research for transformation[xxi].

### 4.2. Depok, Jakarta

**Lisman**: "In Depok, our mission transcends merely meeting the SDGs for drinking water supply. We're envisioning a holistic approach that not only secures clean water but also safeguards our rivers and aquifers from pollution, particularly from plastics, while nurturing a circular economy to manage waste more effectively."

**Rudolf:** "That's an ambitious yet crucial goal, First Author. How do you plan to tackle the pervasive issue of plastic waste in water sources? Our strategy involves a multi-tiered approach. Firstly, we're looking at community-driven waste management programs that empower residents to reduce, reuse, and recycle waste. Additionally, we're exploring innovative technologies for waste collection and recycling that can transform waste into valuable resources, hence contributing to the circular economy."

**Lisman:** "Engaging the community is key. But how do you intend to ensure these practices are adopted widely across Depok? Education and awareness campaigns are at the heart of our strategy. We plan to collaborate with schools, local businesses, and community leaders to disseminate information about the importance of protecting water sources and the benefits of waste reduction and recycling. Moreover, we're considering incentives for communities and businesses that adopt sustainable practices."

**Janet**: "It sounds like a comprehensive plan. What about policy support and funding?"

**Lisman**: "We're in dialogue with local authorities to align our initiatives with existing policies and to explore new regulations that support water conservation and waste management. On the funding front, we're looking at a blend of government support, private sector partnerships, and international grants to kickstart and sustain these initiatives."

**Janet**: "Collaboration seems to be a recurring theme in your strategy.

**Lisman:** ". The challenges we face are interconnected, and so must be our solutions. By fostering partnerships across sectors and engaging the community, we can work towards a sustainable Depok that

not only meets the SDGs but sets a benchmark for integrated urban water and waste management."


Focus group discussion on the link between dumping plastic in the ocean and the food chain.[xxii]

**Lisman :** I am particularly concerned about climate change and the urban poor who inhabit the river banks[xxiii]. Do you know when plastic bags are washed away by the rivers into the sea, the fish eat the plastics. The Fisher seller: … I heard about fish eat the plastic.

**Janet:** Your discussion with community groups focuses on recycling, repurposing and re-generating the environment through removing plastic , repurposing it and recycling it . The focus is on creating jobs with the urban poor [xxiv] . The other R which is vital is re-generation .

**Lisman :** Yes, our circular economy agenda for rivers in the fast developed city of Depok city is to reduce the amount of dumped plastic waste and to maximise the benefits of cleaning up the rivers water supplies. Depok provides water for Jakarta with a growing population of about 10.5 million people. The subsidence of city land by 6 cm yearly is a result of the massive amount of ground water mining as people try to obtain clean and cheap water. Jakarta city residents and the industrial sector require between 400 million m2 to 800 million m3 of water every year. Groundwater mining causes seawater intrusion. Sea water is suspected to have penetrated the cave. Groundwater mining also causes a decrease in the land surface. In 2022 there will be a subsidence of around 6 cm. If the decline is constant over the next 10 years, the land surface will decrease by 60 cm. On the other hand, even though international companies have been involved, namely the services of this problem, widespread groundwater extraction since the 1970s.

Water is needed by residents and industry in Jakarta in very large quantities. Regulation of groundwater extraction has been in place since the 1990s. The number of water pumps increases day by day. For a long time, groundwater use has been erratic. According to analysts, including the World Bank, if groundwater mining in Jakarta (600.15 km2; 10.5 million population) is not stopped, then in 2035, the land surface in the city of Jakarta will be 75% below sea level. This season, the average surface decrease is 6 cm per year.

- **Why is groundwater the dominant source for residents and industry in Jakarta?**

The answer is the slow pace of the Jakarta water company in increasing piped water supplies throughout the 1950s until now. The transition in management of the forerunner company PAM JAYA was very bad in the period 1950 to 1970. The modern managerial transition did not take place, because PAM was managed by city government management, which was also unable to meet the rapid flow of refugees from the regions to Jakarta. Another complicated situation occurred when the Public Private Partnership scheme was implemented in early 2000. Two world capital companies, Thames Water (UK) and Liones (France) were included to change PAM to be efficient and effective. Various efforts have been made to modernize water supply. One important agenda that will determine the success of PPP is if the old system of water sources, namely groundwater mining

….Several strategies could be effective. Firstly, upgrading and maintaining the water distribution infrastructure to prevent physical losses. Secondly, implementing advanced metering and monitoring technologies to detect leaks and unauthorized connections early. Thirdly, enhancing community engagement to raise awareness about the importance of conserving water and reporting leaks. While the upfront costs might be high, the long-term benefits in terms of water conservation, improved service delivery, and financial savings for the water utility justify the investment. … The reality faced in late 2022 is the fact that only 55% of Jakarta households have access to PAM Jaya. Moreover, more than 400 large buildings, namely hotels, markets, malls, restaurants, office buildings and government buildings, still mine groundwater. So, if it is related to the 400 million – 600 million consumption scheme in Jakarta every year, then if it has been implemented.

### 4.2.1 Bottled Water and its challenge

**Lisman :** Water is transported to Jakarta far from the mountains. Every day estimated around 3,000 drinking water tanks transport water from Sukabumi and around Ciburian, West Java. The development of the bottled water industry is due to residents' need for drinking water.

Regarding this, our research informant, the former PAM Jaya operations director, stated that in fact the raw water that has been Pam JAYA's water source has been the result of river water refinery. The river water is stored in several giant ponds in the PAM Jaya area. The Dutch colonial government in the 1800s built the city of Depok[xxv]. …According to urban functions, Depok City is home to around 1 million workers who work in Jakarta. The transfer or change of Depok as a city is a consequence of the centralization of the function of the city of Jakarta as the center of Indonesian government. At its inception in 2001 it only had a population of 400 thousand people. However, in 23 years the population of Depok City increased to 1.93 million, or 4 times in more than 20 years. The driver of this increase was the move of the largest university campus in Indonesia, namely the University of Indonesia, to the city of Depok. The extraordinary increase in the population of Depok City has created multi-dimensional problems.

### 4.2.2. Potential of the Circular Economy and 3 Rs (Recycle, re-purpose and re-use

**Lisman**: "There are three rivers across Depok that carry water to the Jakarta bays namely Ciliwung, Sugutamu and Krukut rivers. Unfortunately the rivers become conduits for urban waste to the ocean, exacerbating pollution. This situation underscores a critical disconnect between our urban lifestyles and the health of our waterways. It's a concerning trend. The pollution not only harms the environment but also affects Jakarta's water supply. How can we address this issue more effectively?

**Janet:** It is also a problem that is increasing in South Africa as reliance of bottled water increases , because tap water is no longer trusted. Bottled water quality is also questionable as it needs greater regulation. One promising approach is to embrace the circular economy.

**Lisman :** Particularly focusing on the 3 Rs: Recycle, Re-purpose, and Re-use. For instance, Bu Timbul and her community received training on waste segregation, which is a step in the right direction."

**Bu Timbul**: "Indeed, the training was enlightening, and many of us were ready to implement these practices. However, the lack of follow-through with the promised bins has stalled our efforts."

**Lisman**: "That's a gap we need to bridge. Community willingness is there, but support systems must be strengthened. Implementing a robust recycling program and providing the necessary resources, like bins and regular waste collection, could transform these intentions into action. Partnerships with local businesses, NGOs, and government agencies could be key. For example, creating community recycling centers that not only collect but also find innovative ways to re-purpose and re-use plastics and other materials could set a precedent. By turning waste into resources, we not only clean our rivers but also create economic opportunities within these communities. It's about creating a sustainable ecosystem where environmental conservation and community empowerment go hand in hand. With the right support and collaboration, Depok's rivers can be revitalized, benefiting both the environment and the residents."

## 4.3.Regeneration of rivers and habitat: a reflection on water insecurity

**Janet**: Mitigation and adaptation to climate change requires a regional socio-economic and environmental governance approach that addresses ways to protect the sources of water for West Java as well as the management of water supply. Furthermore, it requires local governments in collaboration with local providers to support and subsidize rainfall catchments , well and spring management and the management of refuse, sanitation and chemical wastes in the informal settlement areas of Jakarta

### 4.3. Tangerang, Banten

**Riswanda** : In Tangerang, the issue of water justice arises where water becomes commodity with significant price value. In some areas, people pay 200.000 rupiahs (20 AUD) for a medium size container of clean water. In very dry season, water company has to deliver water service to selected areas by hours due to dry river / long dry season like now. This is the monthly income[xxvi] of Indonesians: ten percent of Indonesians earn only : 22.000.000 = 2000 AUD monthly, the rest 80 percent which is less than 200 AUD monthly.

The semi-private enterprise today has issues of delivering public service and making profit, including water company in Tangerang that respects the rights of each mother and child to academic or vocational education and training. In some of the upstream villages, flood plain areas of Jakarta and Banten coastal areas, the lack of affordability of clean safe water, lack of re-generation of the environment and health related issues need further attention ( see Riswanda, 2023/4 forthcoming). In Banten coastal areas, people live in the informal houses alongside the river, and are dependent of fishery and aquaculture. Most of these people belong to the poorest sections of the Banten Province. (Riswanda, 2023/4 forthcoming) is discussing the needs for a proper indigenous policy (an extended paradigm of indigenous politics) and practical community development opportunities[xxvii]. Riswanda is based at Baduy Dalam (Inner Baduy) a thick description which is about how an indigenous community live close with nature and the challenges they face in achieving education and public health outcomes

It also explores their notions of norms and values drawing on Douglas' (1966) of where to draw boundaries and the implications for gender rights in a largely patriarchal society.

## 5. Discussion :Ways forward?

**Rudolf :** We need an incentive to implement sharing water across up and downstream villages. The incentive system implementation could operate a smart contract.

**Janet:** The point made by Ida is that the majority of villagers in Tarumajaya cannot afford piped water as the water is priced for profit and sold to those who can afford it. The water is privatised and sold

**Rudolf** : An innovative system could be proposed for the Citarum River to incentivize villages in the upper stream to maintain the river's water quality by compensating them. The river could be divided into several sections corresponding to the different villages that the river flows through.

Each village in the upper section could be responsible for maintaining the water quality of the river as it passes through their community. The quality of the water could be measured using IoT sensors and data gathered through AI analysis. The data could then be stored on a blockchain-based system called Water Ledger, which enables the tracking and verification of water quality data and trading water quality credits.

The villages in the lower section could then purchase water quality credits from the upper section villages. This could provide an incentive for the upper section villages to maintain the water quality of the river since they will be able to sell their water quality credits to the lower section villages. The compensation received by the upper section villages through the sale of their water quality credits could be used for community development projects and other environmental initiatives.

**Janet:** This would require public-private partnerships that protect people and the environment

**Rudolf :** Yes, by implementing this system, the Citarum River, for example could be effectively managed and sustained by the collective effort of all the villages involved. It could provide a fair compensation system that encourages the responsible use of natural resources while promoting environmental sustainability.

**Janet**: Instead of displacing species through deforestation and inappropriate agriculture and attempt to re-introduce local indigenous species is central, thus we aim to protect sources of water by protecting forests and soil though preventing deforestation and organic farming.[xxviii] Instead of diving homeless people from the river banks it is vital to manage the ecological footprint through setting up locally based enterprises to support a circular green economy. This could be rooted in the policy espoused by Jokowi's 'One Village, One or Many Enterprises' approach and the notion that community co-operatives can :' Learn, Earn and Grow a Future'.

This is achievable through providing a culturally appropriate public health education on ways to manage the population through a demographic transition that respects the rights of each mother and child to academic or vocational education and training. The loss of farm land and destruction of the water sources is caused by development at the expense of habitat on which human beings and other species are dependent. In some of the upstream villages, flood plain areas of Jakarta and Banten coastal area, the lack of affordability of clean safe water, lack of re-generation of the environment and health related issues will be addressed through participatory action research on the cyclical green economy approach together with the team spanning University of Indonesia, Universitas Padjadjaran and Universitas Sultan Ageng Tirtayasa, Kota Serang, Indonesia University of Adelaide.

The issues experienced in Indonesia are the issues being experienced in South Africa where inorganic fertilisers pose along with pollution from sewerage pose a threat to rivers and coastal waters. The Fish Hoek Valley where the Janet is based is a case in point[xxix] ranging from water shortages[xxx] to pollution linked with sewage plants failing during power outages to contamination[xxxi] with herbicides including glyphosates[xxxii] , a range of pharmaceuticals[xxxiii] and plastic.

## 5.1. Incentive System Implementation

**Rudolf :** The proposed innovative system [xxxiv] for the Citarum River aims to incentivize villages in the upper stream to maintain the river's water quality by compensating them through the villages in the lower section. The river could be divided into several sections corresponding to the different villages that the river flows through. Each village in the upper section could be responsible for maintaining the water quality of the river as it passes through their community. The quality of the water could be measured using IoT sensors and data gathered through AI analysis. The data could then be stored on a blockchain-based system called WaterLedger, which enables the tracking and verification of water quality data and trading water quality credits.

The villages in the lower section will be able to purchase water quality credits from the upper section villages. This could provide an incentive for the upper section villages to maintain the water quality of the river since they could be able to sell their water quality credits to the lower section villages. The compensation received by the upper section villages through the sale of their water quality credits could be used for community development projects and other environmental initiatives.

By implementing this innovative system, the Citarum River could be effectively managed and sustained by the collective effort of all the villages involved. It provides a fair compensation system that encourages the responsible use of natural resources while promoting environmental sustainability.

## 5.2. Potential of the cooperative model

**Janet**: "Indra, your expertise in complex project management and system reliability could offer fresh insights into our water governance challenges. In Depok, as in many parts of Jakarta, we're grappling with pollution, inefficient water distribution, and the urgent need for sustainable management practices. How do you see your field contributing to these issues?"

**Indra Gunawan**: "The problems you've outlined are indeed complex, but they are not insurmountable. From an engineering and project management perspective, we can approach these issues systematically. For example, applying reliability modelling to the water distribution network could help us identify critical failure points and prioritize maintenance efforts to reduce downtime and improve efficiency."

**Lisman**: "That's intriguing, Indra. But how do we translate these technical solutions into actionable strategies that local governments and communities can implement?"

**Indra Gunawan**: "It starts with comprehensive data collection and analysis. By understanding the specific challenges of each area, whether it's pollution levels in the rivers or inefficiencies in the water supply network, we can develop targeted interventions. For instance, predictive maintenance strategies, informed by reliability modelling, can preemptively address issues before they lead to significant disruptions."

**Janet**: "Data-driven approaches certainly have potential. However, we also need to consider the human element—engaging communities and local authorities in these technical solutions. How do you propose we bridge this gap?"

**Indra Gunawan**: "Collaboration and communication are key. We need to translate technical findings into understandable and relatable information for non-experts. Workshops, seminars, and participatory planning sessions can be effective ways to involve community members and policymakers. Moreover, demonstrating the potential cost savings and efficiency gains from adopting these technical solutions can make a compelling case for their implementation."

**Lisman**: "Indeed, making the technical aspects accessible is crucial. Do you think there's scope for integrating advanced technologies, like IoT and AI, in managing our water systems more effectively?"

**Indra Gunawan**: "Absolutely, Lisman. IoT devices can provide real-time monitoring of water quality and distribution infrastructure, while AI can analyze this data to predict trends and identify issues before they escalate. Such technologies not only enhance our ability to manage water systems efficiently but also empower communities with information about their water usage and the health of their local water sources."

**Janet**: "Integrating such technologies could transform water governance. It's about creating a synergy between technical innovations and community-led governance initiatives."

**Indra Gunawan**: "Precisely, by leveraging technology within a participatory governance framework, we can foster a more resilient and sustainable water management ecosystem that benefits all stakeholders."

**Rudolf:** The development of a multi-stakeholder service cooperative with the latest technology, particularly using DAO (Distributed Autonomous Organization), has the potential to create a significant impact on the Citarum Watershed region. The following are some of the potential impacts:

1. Promotion of Regeneration and Sustainable Development: The cooperative model promotes sustainable economic growth by providing small-scale producers with access to markets and fair prices for their products. This can help to improve the livelihoods of local communities and promote economic

development in the region. The use of technology, such as IoT, AI, and Blockchain, can further enhance the efficiency and scale of operations, leading to more significant economic benefits.

2. Reduction of Poverty: The cooperative model can help to reduce poverty in the Citarum Watershed region by providing passive income to local communities. By offering access to markets and support services, small-scale producers can increase their income, leading to an improvement in their standard of living. Additionally, the cooperative model promotes inclusive economic growth, where benefits are shared among various stakeholders, thus reducing inequality.

3. Improvement of Quality of Life: The cooperative model can improve the quality of life for local communities by providing access to support services, such as training and credit, to improve the skills of small-scale producers. With increased income, individuals and communities can access basic needs such as food, shelter, and healthcare. Additionally, the cooperative model encourages the use of modern technologies and practices, leading to better product quality and environmental sustainability.

The development of multi-stakeholder service cooperative using mapping (see Wirawan, 2024, companion paper to be presented at ISSS, 2024 ) has the potential to create a significant impact on the region. By promoting sustainable economic growth, reducing poverty, and improving the quality of life for local communities, the cooperative model could contribute to the long-term well-being of the region.

## 6. Developing a new scheme of PPP

**Rudolf :** "According, to a number of experts, water governance sometimes seems too idealistic. Luckily, G-20 experts now advise the high consequences of the current linear business as usual economy.

The linear economy process turns out to give rise toward a burden waste. A circular economy process, in which the impact of good waste management will simultaneously reduce the waste burden, as well as protect water sources and involves the private sector roles can be explored. To shift it to a circular economy, of course we need a driver. Environmental vulnerability—has never been a consideration as much as it is today. That shows the threat of climate change is more devastating than expected. Solution efforts become less effective. In fact, according to several sources, the success of SDGs 2030 depends on SDGs related to water. On the other hand, if you fail to address the water sufficiency target, your other successes will be clouded. From our exploration of water governance.

**Lisman:** I conclude that the most strategic breakthrough is how to get all parties to involve rivers as a crucial element in the framework of the SDGs and others. We need to agree on the importance of changing the approach to the river, because it is the river that brings fresh water from upstream, distributing it directly or indirectly such as seepage into the land to the left and right of the river—then crop plants will be sustainable. The application of modern technological devices will be effective for communities along the river to become themselves when they see that the water has been treated with value, as at the beginning of our civilization. The proposed SDGs for 2030 depends on local and regional governance.

## REFERENCES

Bateson, G. (1972). *Steps to an Ecology of Mind*. New York: Ballantine.

Bateson, N. (2021). *Plenary International Systems Sciences*. https://norabateson.wordpress.com/2017/05/28/warm-data/

Badan Pusat Statistik—*Central Board for Statistic* (2013). Data Kependudukan Nasional. *National Demographic Data*. ( http://www.bps.go.id)

Bateson, N. (2021). *Plenary International Systems Sciences*. https://norabateson.wordpress.com/2017/05/28/warm-data/

Bicknel, Jane, David Dodman and David Satterthwaite (eds). 2009. *Adapting Cities to Climate Change Understanding and Addressing the Development Challenges*. London: EarthScan .

Delinom, R.M. (2011) 'The Proposed Groundwater Management for the Greater Jakarta Area, Indonesia' in M Taniguchi (ed). *Ground Water and Subsurface Environments: Human Impacts in Asian Coastal Cities.* New York: Springer. p 35-59

Gain, AK, Josselin J. Rouillard and David Benson. (2013). 'Can Integrated Water Resources Management Increase Adaptive Capacity to Climate Change Adaptation? A Critical Review' *in Journal of Water Resources and Protection* (Vol 5)

Hill, M. 2013. *Climate Change and Water Governance: Adaptive Capacity in Chile 3 and Switzerland*, Advances in Global Change Research 54, DOI 10.1007/978-94-007-5796-7_1, Springer Science Business Media Dordrecht 2013

IPCC ( 2023) CLIMATE CHANGE 2023 Synthesis Report Summary for Policymakers www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

International Housing Coalition (2011). 'Adapting to Climate Change: Cities and the Urban Poor'. Washington DC: IHC

Manurung, L. (2007). 'The Jakarta Water Service: The Case of an uneasy Public-Private Partnership'. Flinders University: PhD thesis

Manurung, L , Runturambi , S.J. Climate Change and Urban Poor: Water-related Behavior in Jakarta[xxxv] Climate Change and Urban Poor: Water-related Behavior in Jakarta. *International Journal of Progressive Sciences and Technologies*. ISSN 2509-0119 Vol 39. No 2 (2023)

OECD (2010), Cities and Climate Change, London: OECD Publishing. http://dx.doi.org/10.1787/9789264091375-en

Simbolan ( 2019) Critical Systems Thinking Review on the Challenges of Decentralised

Drinking Water Management in City of 'Nauli', Indonesia on a PhD project

and Urban Poor: Water-related Behavior in Jakarta[xxxvi] Climate Change and Urban Poor: Water-related Behavior in Jakarta

OECD (2010), Cities and Climate Change, London: OECD Publishing. http://dx.doi.org/10.1787/9789264091375-en

Maturana HR. 2002. Autopoiesis, structural coupling and cognition. Cybernetics and Human Knowing 9(3–4): 5–34.

McIntyre-Mills, J. J. (2022). The importance of relationality: A note on co-determinism, multispecies relationships and implications for COVID-19. Systems Research and Behavioral Science, 39(2), 339–353

McIntyre-Mills, J, Makaulule, Lethole, P, Widianingsih, I. Wirawan, R. and Norma Romm ( 2022) Learning with indigenous leaders in Africa and Indonesia through a community of practice . Panel Presentation in Balancing Individualism and Collectivism 66th Meeting of the International Society for the Systems Sciences

McIntyre-Mills, J. (2003). Critical systems praxis: participatory governance for social and environmental justice'. The Contemporary Systems Series. Kluwer/Springer, London.

McIntyre-Mills, J. (2014).Systemic Ethics and non-anthropocentric stewardship Springer, New York. pp 65-97.

McIntyre-Mills, J.J. and Romm, NRA (Eds) (2019) Mixed Methods and Cross Disciplinary Research: Towards Cultivating Ecosystemic Living. Cham, Switzerland. 10.1007/978-3-319-58014-2.

McIntyre-Mills, J. J. (2022) Fluid, organic thinking and relationality: implications for education and international relations by McIntyre-Mills, J. J. In McIntyre- Mills, J and Corcoran-Nantes ( Eds) Transformative Education for Re-generative Development: Pathways to Sustainable Environments Springer Nature. Singapore. https://doi.org/10.1007/978-981-19-3258- pp 31-46

McIntyre-Mills, J. J. ( 2022 ). Nurdles and food security Education for wellbeing :implications for Pan-African Social and Environmental Justice McIntyre-Mills, J. J. In McIntyre-Mills, J and Corcoran-Nantes ( Eds) Transformative Education for Re-generative Development: Pathways to Sustainable Environments, Springer Nature. Singapore.pp47-82

McIntyre-Mills, J. Wirawan, R. and Widianingsih, I (2022) Learning from nature's classroom : reframing economics , accounting and accountability In McIntyre-Mills, J and Corcoran-Nantes ( Eds) Transformative Education for Re-generative Development: Pathways to Sustainable Environments, Springer Nature. Singapore.pp119-140

McIntyre-Mills, J. (2021) McIntyre-Mills, J. (2021)Chapter 5: McIntyre-Mills, J: Consciousness for Balancing Individualism and Collectivism'. in McIntyre-Mills, J.J. and Corcoran Nantes, Y. 'From Polarisation to Multispecies Relationships in the Age of Mass Extinctions' Springer Nature Singapore.pp67-86.

Meadows, Donella H. . Meadows Dennis L, Randers,J. Behrens, W.W III (1972) A report for the Club of Rome's project on the predicament of mankind Universe books. New York

Murray J, Dey C, Lenzen M. 2007. Systems for social sustainability: global connectedness and the Tuvalu test. Cybernetics and Human Knowing. 14(1): 87–105.

Riswanda, Corcoran Nantes and McIntyre-Mills, J. 2016. 'Re-framing prostitution in Indonesia: a critical systemic approach'. Systemic Practice and Action Research, ISSN: 1094-429X (Print) 1573-9295 (Online) Scimago, h index of 27 Q2 Strategy and Management Scimago.

Riswanda & JanetMcIntyre-Mills & Yvonne Corcoran-Nantes, 2017. "Prostitution and Human Rights in Indonesia: A Critical Systemic Review of Policy Discourses and Scenarios," Systemic Practice and Action Research, Springer, vol. 30(3), pages 213-237, June.Q2 Strategy and Management Scimago

Rees, W. (2011) Resilient Cities: What if 'can-do' can't? (PCI Fellow William Rees) https://www.youtube.com/watch?v=ugv0OY6LyuEStudley, J.(2019) Indigenous sacred natural sites and spiritual governance : the legal case for juristic personhood. London. Routledge.

Rees, W. (2022) " Why things will likely get worse: a systems perspective" Plenary speaker for International Systems Sciences https://stream.syscoi.com/2022/07/01/international-society-for-the-systems-sciences-66th-annual-conference-online-conference-7-11-july-2022/

Rittel H and Webber M. (1984), Planning Problems are Wicked Problems, Developments in Design Methodology. New York: Wiley.

Simbolan, J. 2019. Water as a public good: A critical review of water governance in Nauli City Principal

Simbolon J**.,** McIntyre-Mills J. (2019) Chapter 9. What Is Problem Represented to Be: Water Scarcity, Water Mismanagement or Misdirecting the Systems? In: McIntyre-Mills J., Romm N., Corcoran-Nantes Y. (eds) Democracy and Governance for Resourcing the Commons. Contemporary Systems Thinking. Springer, Cham, pp. 233-264.

Simbolon, J., and McIntyre-Mills, J. (2019)**.** Wicked problems and water management in Nauli, Indonesia In McIntyre-Mills, J, Romm, 2019. Mixed Methods and Cross Disciplinary Research: Towards cultivating eco-systemic living. Cham, Switzerland. pp.401-428

Simbolon, J Critical Systems Thinking Review on the Challenges of Decentralised Drinking Water Management in City of 'Nauli', Indonesia In: McIntyre-Mills J., Romm N., Corcoran-Nantes Y. (eds) Balancing Individualism and Collectivism. Contemporary Systems Thinking. Springer, Cham 285-317 Springer

The world's most polluted river | DW Documentary (https://www.youtube.com/watch?v=GEHOlmcJAEk&t=1253s&ab_channel=DWDocumentary)

12. Saving Citarum: Indonesia's Fight To Clean 'Dirtiest River In The World' | Once Upon A River (https://www.youtube.com/watch?v=WqOyR603WPE&t=181s&ab_channel=CNAInsider)

United Nations. (2013). We can End Poverty. (http://www.un.org/ millenniumgoals/pdf)

United Nations Office for Disaster Risk Reduction. (2015–2030). Sendai Framework. http://www.preventionweb.net/drr-framework/sendai-framework/.

United Nations Office for Disaster Risk Reduction. (2017). http://www.preventionweb.net/files/55465_globalplatform2017 edings.pdf.

Von Foerster, H. (1992). Ethics and second order cybernetics. Cybernetics and Human Knowing, 1(1), 9–19

''Wirawan, R., McIntyre-Mills, J.J., Makaulule, M. Lethole,P. Pitsoane, E.· Arko Achemfuor, A. Romm, NRA ( 2023) Together We Can Grow: Resourcing the Commons Through Pathways to Wellbeing. Syst Pract Action Res (2022 volume 36: 641–690 ). https://doi.org/10.1007/s11213-022-09613-z

Widianingsih, I, McIntyre-Mills, J.J. Sumadinata, W.S., Rakasiwi, U.S. , Iskandar, G.H Wirawan, R ( 2023) Indigenous Sundanese leadership: eco-systemic lessons on zero emissions A conversation with Indigenous leaders in Ciptagelar, West Java. Systemic Practice and Action Research. 36(2):321-353.doi: 10.1007/s11213-022-09606-y

Widianingsih,I. 2014. 'International Donor Policy & Local Government in Indonesia: Establishing Good Governance?' Principal

Yoshikoshi, A (2011) 'Urban Development and Water Environment Changes in Asia Megacities' in M Taniguchi (ed). Ground Water and Subsurface Environments: Human Impacts in Asian Coastal Cities. New York: Springer. p 35-59

[i] McIntyre-Mills, J. (2017). Planetary Passport: Re-presentation, Accountability and Re-Generation. Springer International Publishing AG, Cham, Switzerland.

[ii] This work reflects on the case studies facilitated with a community of practice by the second author of this paper. The location of our research responds to the challenge of water and food insecurity in areas where development and urbanization is rapidly destroying habitat. For the purpose of this research we will monitor wellbeing indicators in three villages spanning the highland, flood plains and a coastal region , namely Taramajaya, Jakarta and Bantam Province. Widianingsih et al ( 2023) focuses on demonstrating how to make a difference through green job creation at the local level so that the lessons can be scaled up . Riswanda ( 2018a,b and forthcoming) focuses on research with the poorest women in particular who are indebted and who need to find a way out of poverty.

[iii] First order steering, second order contextual considerations and third order constructivist approaches , based on the notion that we live in 'a participatory universe'.

[iv] Mr. Arief's concerns as chair of Pamjaya, Jakarta's largest provider of water about water availability and water loss in Jakarta . McIntyre-Mills' concerns about climate change and the need for systemic governance to address mitigation and adaptation from the highlands areas where re-forestation and protection of the water table along with re-generative agriculture and businesses need to be encouraged through systemic participatory governance. Zoom engagement via community of practice with policy and governance stakeholders, NGO leaders to discuss water insecurity and Agro-ecology leaders.Wirawan and the team are currently working on supporting circular , organic economies to protect and re-generate the environment. This paper contributes by conducting upstream, midstream and downstream case studies and interviews with stakeholders.

The team engages with :

- The CEO /Managers of the Jakarta water company to address water dignity for the poorest of the poor in Jakarta using a constructivist approach .
- Public sector officials in forestry and environmental affairs portfolios to discuss ways to protect water security through agro -ecology.

- The team introduce members of the community of practice to the principles of organic agroecology and explain the importance of protecting ground cover and the water table through re-forestation nd organic agriculture.

[v] See other companion papers at ISSS in Balancing Individualism and Collectivim using this dialogical approach enabling the voices of many diverse stakeholders to be heard in McIntyre-Mills 2024 with a community of practice

[vi] This occurred during 2018 as part of a data gathering exercise linked with the Mixed Methods Conference spanning Universitas Padjadjaran and Flinders University

[vii] Bringing PAM Jaya in other areas outside Jakarta, Tarumaja village as an instance, requires particular water policy coming across different authorities given Indonesian local autonomy politics. Administrasi Publik Magister to Everyone 10:28 AM : By regional autonomy politics, as part of 1998 Indonesia political reform, local politics influence the way local authorities execute water management. Some regions set up their own political boundaries of which shapes river management as well. Citarum River and Cidadane River for example show different management influenced by each region very own local politics trait (West Java Provincial government and Banten Provincial Government). Public-private-community partnership could be a way to work across different political boundary. National priority budget would be delivered to regions with some degrees of innovations linking in corporate social responsibility funding.

[viii] see the Springer volumes to date, namely: Balancing Individualism and Collectivism ( 2018), Democracy and Governance to Protect the Commons( 2019) , 'Together we can Grow'( Wirawan, McIntyre-Mills et al 2023) and 'Learning, Earning and Growing a Future'(see Transformative Education, 2022, 'From Polarisation to Multispecies Relationship, 2021).

[ix] The area of concern requires a critical systemic approach to address the related concerns with a sociologist, demographer, town planner , indigenous leaders with local knowledge of the environment in catchment areas, public administration , oceanographer , water researchers with agroecology background .

[x] The stakeholders have differing perception's regarding the Jakarta's water service PPP. While the local government insisted the fairness of low price water for households, the private operator adhered to the business plan already agreed to by partners to periodically introduce tariff hikes. The intention to increase water tariffs aimed for cost recovery to pay the previous debt and to cover all the cost of production. This policy makes high water costs which the poor could not buy. This policy implies the issue of public health because the poor could not buy the safe water except take ground water.

- The PPP of Jakarta was established without open tender bidding or open discussion on the contract.
- High social, economic and environmental cost associated with the supply of water through this partnership, as the result of the high water tariff while disincentive regulations against ground water extraction has not appropriately provided.
- Estimated half of the Pam Jaya's customer also take ground water. It is mean the behavior of some Pam Jaya's customer influenced by the inappropriate regulations.
- The uneasy public private partnership of Jakarta's water service can easily understand because from the start, two partners did not explore and exercise every point of issue clearly and cross cutting edge contract.
- In an emerging local democratic local political setting and self-serving local bureaucratic tendencies which implicit unawareness toward current and the future water crises and environment degradations from an overly loose or unreliable regulations. In this situation, differing agenda obstructs the value of PPP. It has shown by the conflicting policy. To minimize the utilization of ground water, the business sector user must to pay water mining tax. Since the ground water tax was lower than continually hike prices of piped water, the tax payer chosen to pay tax then went stop ground water mining.

[xi] Simbolan ( 2019) Critical Systems Thinking Review on the Challenges of Decentralised

Drinking Water Management in City of 'Nauli', Indonesia on a PhD project that "strives to assess the performance of decentralised drinking water management in the city of Nauli, Indonesia. The implementation of decentralised government system followed by decentralising some functions including drinking water services is unsatisfactory in providing access to drinking water for all residents in the city of Nauli. Nauli Municipality

that has just split up as an autonomous local government under the decentralised government system in Indonesia is facing conflicts in providing water provision to the society, since there are three public water companies in this region: City PDAM, District PDAM, and Provincial BLUD. Furthermore, these governments and their water companies seem to forget the main objective of government in water provision as stated in the Indonesia Constitution: to fully control the water and manage it for meeting the people's needs. The aim of this research is to apply Ulrich's critical systems heuristics (CSH) to address the following research questions:

(i) how effective is the current decentralised water management system? and

(ii) how the current system can be improved and what ought to be done?

[xii] Kpbujabarpr…bppeda19105157

[xiii] Widianingsih, I , McIntyre-Mills et ql, 2023, Wirawan, McIntyre et al ( 2023)

[xiv] Second Author Manurung is currently undertaking research in Depok that builds on his thesis Manurung, L. (2007). 'The Jakarta Water Service: The Case of an uneasy Public-Private Partnership'. Flinders University: PhD thesis and contributing to a series of joint on the need to move away from water management to governance to protect biodiversity and the sources of water : a critical systemic case study and discussion of the implications for social and environmental justice and the importance of indigenous and local knowledge. See Manurung, L , Runturambi , S.J. Climate Change and Urban Poor: Water-related Behavior in Jakarta Climate Change and Urban Poor: Water-related Behavior in Jakarta.

[xv] Riswanda et al , in progress, Bantem province is a coastal area prone to flooding where the mangroves are under threat .

[xvi] At a FGD on 17th Oct it was emphasized that plastic waste should be reduced and recycled and that the village leadership could be model more sustainable living by not using plastic water containers. The PKK won an award for online marketing. .

[xvii] Manurung, L. 2006. 'Jakarta Water Service: The case of an uneasy public–private partnership'

[xviii] http://tarumajaya-village.uranus.web.id/_a.php?_a=desa-kecamatan-kota&tanda=kota&prov=West%20Java&provkot=Kab.+Bandung&desa=Tarumajaya&kec1=Kertasari&_en=ENGLISH

[xix] Ida Widianingsih to Everyone 11:20 AM
https://jurnal.umt.ac.id/index.php/jgs/article/view/1377/992
https://www.proquest.com/docview/2253185519?pq-origsite=gscholar&fromopenview=true

[xx] My published paper on PPP in West Java( Widianingsih[xx]

[xxi] Ida Widianingsih to Everyone 11:20 AM
https://jurnal.umt.ac.id/index.php/jgs/article/view/1377/992
https://www.proquest.com/docview/2253185519?pq-origsite=gscholar&fromopenview=true
Ida Widianingsih to Everyone 11:03 AM
my published paper on PPP in West Java
https://www.scopus.com/record/display.uri?eid=2-s2.0-85111094777&origin=resultslist&sort=cp-f
another published paper of PPP in West Java
https://www.scopus.com/record/display.uri?eid=2-s2.0-85077668484&origin=resultslist&sort=plf-f
Ida Widianingsih to Everyone 11:20 AM
https://jurnal.umt.ac.id/index.php/jgs/article/view/1377/992
https://www.proquest.com/dociew/2253185519?pq-origsite=gscholar&fromopenview=true

[xxii] On one day of October 2023, I set up a meeting to collect data from 8 adult participants. The participants lived at riverbank of Sugutamu river in Depok city. Initially I only planned to collect data about their socio economic background and how they understood the importance of the 3 R and 5 R programs. ….I told them that the question of why we needed to work together would be answered if they understood the contents of the banner. I took this step because in the PAR protocol, participants retain their power and they are free to tell me their thoughts and attitudes. …. It didn't take a long for them to explain the connectedness of three points, namely (rubbish bin) plastic waste and whales. …. My explanation of the 3 R and 5 programs has become easier. Indeed, they have followed the 3 R counselling carried out by the officers from the sub district (kelurahan). The PAR approach empowers and enables advocacy …. Reduce, Reuse, and Recycle," there are two more "Rs" to learn. And, really, the list goes on: refuse, repaint, repurpose, refurbish, reclaim."

[xxiii] Some of these concerns have been discussed in a research report titled 'Wellbeing and Climate Change: A Study of Perception and Interactions across Stakeholders on Mitigation, Governance and Accountability to Address Water Governance.

[xxiv] See https://www.tri-citiesdisposal.com/the-five-rs

[xxv] The Dutch colonial government in the 1800s built the city of Depok which functioned as a clean water supply area for the city of Batavia, Jakarta now. Depok City (200.1 km2) is a satellite .

[xxvi] 2.00000 rupiah (20AUD) approximately
2000,000 million rupiahs (200 AUD) monthly

[xxvii] Local community leaders could create opportunity for public-private-community partnership in setting up a joint co-op or several small enterprises around recycling and upcycling. In terms of linking the partnership with Pamjaya, it is important to set up a waste recycling and upcycling business that could be scaled up as a way to clean up the river and get rid of waste. This type of eco-friendly business should be aiming at supporting social entrepreneurship, based on the idea of creative economy. Pathways to wellbeing might start data foundation to apply UN Habitat digital tools. The barrier of implementing the idea is about providing village IT school, certifying the villagers to operate digital technology. Creative thinking endeavours to come up with business design that connects youth and elders in Banten coastal areas villages. They could make use of Banten art, music and traditional Debus dance to

advertise and grow their business. Art festivals could help facilitate setting up small enterprises in a way where media appearances help with public education on the wider issues. The combination of both is to establish social economic and environmental indicators, which could break out norms and values to the extent where the usage of digital technology is accepted firstly as their new way of life.

[xxviii] https://cities4forests.com/partner-articles/a-5-step-plan-to-protect-and-restore-indonesias-forests/

[xxix] https://www.groundup.org.za/article/beaches-risk-report-reveals-alarming-pollution-along-cape-towns-coast/

[xxx] https://www.brookings.edu/articles/lessons-from-the-cape-town-water-crisis-and-the-need-for-a-renewed-technical-agenda/#:~:text=water%20security%20concerns.-,Water%20scarcity%20is%20becoming%20an%20increasing%20threat%20because%20of%20climate,water%20but%20rather%20pollute%20it.

[xxxi] https://www.politicsweb.co.za/news-and-analysis/beaches-at-risk-report-reveals-alarming-pollution-

[xxxii] https://mg.co.za/environment/2021-09-07-a-cancer-causing-herbicide-has-been-found-in-south-africas-bread-and-flour/#:~:text=glyphosate%20has%20been%20approved%20for,glyphosate%20does%20not%20cause%20cancer.%E2%80%9D

[xxxiii] https://www.timeslive.co.za/news/south-africa/2019-06-26-pharmaceuticals-and-industrial-chemicals-found-in-fish-caught-off-cape-towns-coast/

[xxxiv] Wirawan ( XXXXX) XXXXXXXXXXXXXXXXXXXXXXXXXX

[xxxv]This article draws on the Research Report titled Wellbeing and Climate Change: A Study of Perception and Interactions across Stakeholders on Mitigation, Governance and Accountability to Address Water Governance. It is the result of research on climate change and a series of behaviors urban poor who inhabit the river banks.

[xxxvi]This article draws on the Research Report titled Wellbeing and Climate Change: A Study of Perception and Interactions across Stakeholders on Mitigation, Governance and Accountability to Address Water Governance. It is the result of research on climate change and a series of behaviors urban poor who inhabit the river banks.